Computer Software Engineers, Systems Software

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What They Do

Computer Software Engineers, Systems apply the principles and techniques of computer science, engineering, and mathematical analysis to the design, development, testing, and evaluation of the software and systems that enable computers to perform their many applications.

Systems Software Engineers working in applications or systems development analyze users' needs and design, create, and modify general computer systems. Engineers can be involved in the design and development of many types of software including software for operating systems, network distribution, and compilers, which convert programs for faster processing. In programming, or coding, Systems Software Engineers instruct a computer, line by line, how to perform a function. Engineers must possess strong programming skills, but are more concerned with developing algorithms and analyzing and solving programming problems than with actually writing code.

Systems Software Engineers coordinate the construction and maintenance of a company's computer systems, and plan their future growth. They coordinate each department's computer needs within a company and make recommendations on technical matters. They also might set up the company's intranets, networks that link computers within the organization and ease communication. Many engineers work for companies that configure, implement, and install complete computer systems. In addition, they often work as part of a team that designs new hardware, software, and systems.

Tasks

- Analyze information to determine, recommend and plan installation of a new system or modification of an existing system.
- Confer with data processing and project managers to obtain information on limitations and capabilities for data processing projects.
- Consult with engineering staff to evaluate interface between hardware and software, develop specifications and performance requirements and resolve customer problems.
- Modify existing software to correct errors, to adapt it to new hardware or to upgrade interfaces and improve performance.
- Design and develop software systems, using scientific analysis and mathematical models to predict and measure outcome and consequences of design.
- Develop and direct software system testing and validation procedures.
- Direct software programming and development of documentation.
- Evaluate factors such as reporting formats required, cost constraints, and need for security restrictions to determine hardware configuration.

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- Consult with customers and/or other departments on project status, proposals and technical issues such as software system design and maintenance.
- Advise customer about, or perform, maintenance of software system.
- Coordinate installation of software system.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O*NET) at online.onetcenter.org.*

Important Skills, Knowledge, and Abilities

- Complex Problem Solving — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- Technology Design — Generating or adapting equipment and technology to serve user needs.
- Troubleshooting — Determining causes of operating errors and deciding what to do about it.
- Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- Active Learning — Understanding the implications of new information for both current and future problem-solving and decision-making.
- Programming — Writing computer programs for various purposes.
- Reading Comprehension — Understanding written sentences and paragraphs in work related documents.
- Computers and Electronics — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- Engineering and Technology — Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- English Language — Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- Customer and Personal Service — Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.
- Design — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- Information Ordering — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- Oral Comprehension — The ability to listen to and understand information and ideas presented through spoken words and sentences.

Work Environment

Systems Software Engineers normally work in well-lighted and comfortable offices or computer laboratories in which computer equipment is located. Most engineers work a minimum 40 hours a week, but due to the project-oriented nature of the work, they often work evenings or weekends

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to meet deadlines or solve unexpected technical problems. Due to the nature of the work, Systems Software Engineers are susceptible to eyestrain, back discomfort, and hand and wrist problems such as carpal tunnel syndrome.

As networks expand, Systems Software Engineers may be able to use modems, laptops, e-mails, and the Internet to provide more technical support and other services from their main office, connecting to a customer's computer remotely to identify and correct developing problems.

California's Job Outlook and Wages

The California Outlook and Wage chart below represents the occupation across all industries.

Standard Occupational Classification	Estimated Number of Workers 2004	Estimated Number of Workers 2014	Average Annual Openings	2006 Wage Range (per hour)
Computer Software Engineers, Systems Software				
15-1032	51,100	74,500	2,850	$35.85 to $54.86

Wages do not reflect self-employment.
***Average annual openings** include new jobs plus net replacements.*
Source: www.labormarketinfo.edd.ca.gov, Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.

Trends

The number of Systems Software Engineers is projected to grow much faster than average, particularly in the computer systems design industry, which alone expects 8,200 new Engineers between 2004 and 2014. In fact, new job opportunities for this job are expected in all industries, as businesses and other organizations continue to adopt and integrate new technologies and seek to maximize the efficiency of their computer system. Employers continue to seek computer professionals with strong programming, systems analysis, interpersonal, and business skills. Competition among businesses will continue to create an incentive for increasingly sophisticated technological innovations, and organizations will need more Systems Software Engineers to implement these new technological changes.

Training/Requirements/Apprenticeships

Most employers prefer to hire persons who have at least a bachelor's degree and broad knowledge and experience with computer systems and technologies. System Software Engineers usually focus their studies on computer science or computer information systems. Jobs that are more complex and require a high degree of technical knowledge often require candidates with a master's degree.

Many students seeking software engineering jobs enhance their employment opportunities by participating in internships offered through their schools. These experiences provide students with broad knowledge and valuable hands-on experience, making them attractive candidates to employers. In many firms, mentoring has become part of the evaluation process for new hires.

Systems Software Engineers should be knowledgeable about the different operating systems used by the industry. They must have the ability to problem-solve and configure operating systems to work with all kinds of hardware and adapt the systems to meet the needs of the organization.

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Employers demand new skills as technology continually evolves and advances in the computer field. Systems Software Engineers must acquire these new skills if they wish to remain in this extremely competitive dynamic field. To help keep up with the changing technology, continuing education and professional development seminars are offered by employers and software vendors, colleges and universities, and private training institutions.

Recommended High School Course Work
High school students interested in this kind of work should take computer science and information technology courses, as well as math, sciences, and language arts, in order to develop the skills requirements such as problem solving, reading comprehension, and critical thinking.

Where Do I Find the Job?

Direct application to employers remains one of the most effective job search methods. Use the *Search for Employers by Industry* feature on the *Career Center* page at www.labormarketinfo.edd.ca.gov to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- Computer Storage Device
- Computer Systems Design Services
- Custom Computer Programming Services
- Electricity & Signal Testing Instruments
- Electronic Computer
- Industrial Process Variable Instruments
- Other Computer Peripheral Equipment
- Other Computer Related Services
- Physical/Engineering/Biological Research
- Search, Detection & Navigation Instruments
- Social Science/Humanities Research
- Software Publishers

Search these **yellow page** headings for listings of private firms:

- Computer Manufacturers
- Computer Networks
- Computer Software Developers
- Computer System Designers
- Engineers-Consulting
- Engineers-Industrial
- Engineers-Manufacturing

Where Can the Job Lead?

A career path for Systems Software Engineers might lead to supervisory or managerial positions within a firm, particularly those who have high levels of communication and project management skills. Engineers with degrees in specialties such as electronics, aerospace, or industrial engineering will have many opportunities to make lateral moves into other departments and positions. Those with persuasive and people skills sometimes move into sales positions, which can be lucrative.

Other Sources of Information

Institute for the Certification of Computing Professionals
www.iccp.org

National Workforce Center for Emerging Technologies
www.nwcet.org

Association for Computing Machinery
www.acm.org

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